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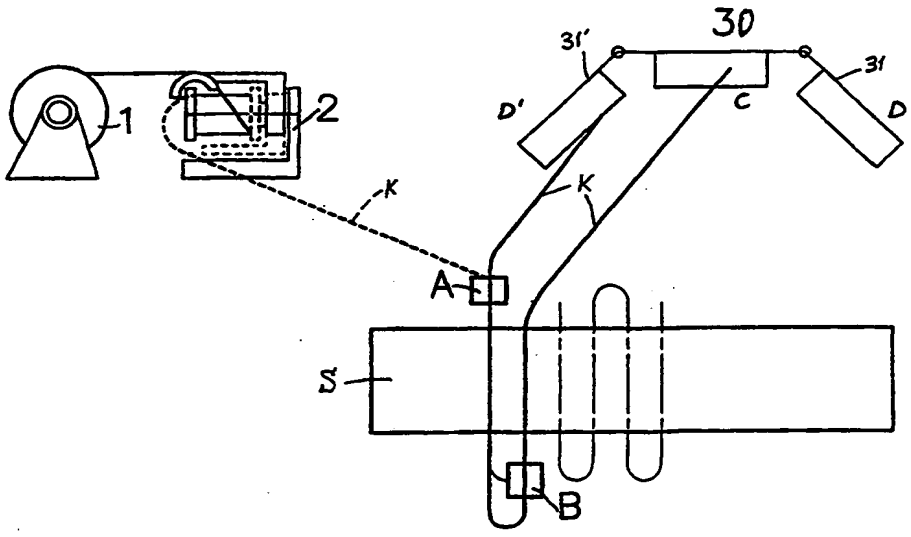

(57) Abstract

In a method for mounting a cable winding, cable by cable, on a stator (S) for a generator a number of cables (K) of predetermined lengths are used for the intended winding. Th method implies mounting each such cable starting at the stator slot representing the middle of an intended coil arc, the first cable half being mounted according to a winding diagram in one direction from the said centre slot and the other cable half being mounted according to the winding diagram in the opposite direction starting from the sam centre slot. The method is carried out by means of a device comprising a drum means, for instance in the form of a capstan machine (2), which originally supports the entire predetermined cable length of a cable. Further, there are two cable feeders (A, B) disposed on either side of the stator (S), which alternatively lay the cable (K) in the stator slots according to the winding diagram by means of intermediate storage means (3, 4).

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METHOD AND DEVICE FOR MOUNTING A WINDING

Technical field

The present invention relates to a method and a device for mounting a winding, on a stator for a generator as specified in the preamble of claim 1 and 6, respectively.

Object of the invention

It is an object of the present invention to facilitate mounting when winding the stator. Another object of the invention is to provide a smooth and reliable laying of the conductor in the stator slots.

For these objects to be achieved, laying of the conductor should be carried out only with a "dead" conductor, i.e. no torsional twist or a minimum of torsional twist of the conductor is allowed when it is inserted in the stator slot.

A conductor which is coiled onto a drum should be uncoiled or pulled off in order for it to be free from twist. It is important that the torsional twist resulting from coiling should be maintained in order for the result to be zero, i.e. without any remaining twist on completion of the uncoiling or pulling off. By pulling off is meant a procedure which is similar to uncoiling, i.e. not unwinding.

The laying of the conductor should be carried out in accordance with a winding diagram, which may be specific to each generator. The stator slots are normally numbered from 1 onwards, clockwise when viewed from the upper side of the stator. Positions in the stator slots (number of "holes" for the conductor) are numbered from 1 onwards with number 1 farthest away from the axle centre of the stator frame. The conductor is laid from slot X, position A to slot Y, position B and so on. Between these positions, the conductor is laid in the form of arcs of pretermined dimensions.

Conductor stiffness and diameter vary within the same generator depending on different voltage levels.

The outer semiconductive layer of the conductor might be soft and must not be damaged and the bending radius of the conductor must not fall below the minimum permissible.

Summary of the invention

The above described objects are achieved by the method according to the present invention, which is characterized by the following steps:

a) using cable for the winding, the winding being wound with a number of cables (K) of predetermined lengths for the intended winding of the stator,

b) placing the centre of the cable, i.e. the location at half the predetermined length, at the location of the stator slot representing the middle of an intended coil arc,

c) starting from the said centre of the coil arc, winding the first half cable length onto the stator in order to form a first coil arc half and part of the total stator winding, and

d) winding the remaining half cable length onto the stator, starting from the said centre of the coil arc and in the opposite direction to the winding of the first half cable length in order to form the other half of the coil arc on the stator and another part of the total stator winding.

The method may be realized by means of a device according to the present invention, said device being characterized by being arranged to be used for winding with cable comprising a number of cables (K) of predetermined lengths for the stator winding, which device comprises a drum means arranged to initially support the entire predetermined cable length, a first and a second cable feeder adjustable relative to the stator slots, which cable feeders are arranged to alternately lay the cable in successive stator slots in accordance with a predetermined winding diagram by means of intermediate storage means, so that first mounting of the first half of the said predetermined cable length is to be carried out starting from the stator slot representing the middle of an intended coil arc, and when winding of the first winding portion is completed, mounting of the second winding portion is to be carried out starting also from said stator slot.

The method implies that first one cable half is mounted, i.e. half the cable length is advanced through the stator slots and laid therein and thereafter the second half of the cable is advanced and laid. In particular the invented

method and device are advantageous when used in connection with an rotating electric machine of the type as disclosed in WO-97/45919.

A cable intended for winding a stator according to the invention may be delivered wound onto a delivery drum. The method according to the present invention may in that case preferably be realized as follows: Unwinding a predetermined length from the delivery drum and coiling it onto a drum means. The cable is cut off when a predetermined length has been coiled onto the drum means. In connection with the coiling, a distinct marking is made at the cable centre, i.e. at half the predetermined cable length. The procedure continues in that a first half of the cable is once more uncoiled from the drum means so as to be mounted in the winding slots of the stator and is thereafter coiled onto an intermediate storage means, the centre marking of the cable being located such that the mark represents the middle of an intended coil arc. The cable is taken from the intermediate storage means, is mounted in winding slots and the rest of the cable is coiled onto the intermediate storage means. This continues until half the cable is mounted. The other cable half is still on the drum means. In the further procedure, the other cable half is uncoiled from the drum means so as to be mounted in the winding slots of the stator and then coiled onto the intermediate storage means. The cable is taken from the intermediate storage means, is mounted in the winding slots and the rest of the cable is coiled onto the intermediate storage means. This continues until the other half of the cable is also mounted.

The intermediate storage means may be formed of two separate capstans, which are used alternately when mounting the cable half in the stator slots, or the intermediate storage means may be formed of a dual drum capstan, the two drums of which are used alternately when mounting the cable half in the stator slots.

The drum means may be formed of a separate capstan machine or it may be formed as an additional drum, the coiling of which is arranged to take place by means of the intermediate storage means, which drum, however, during

uncoiling is arranged separately from the intermediate storage means.

The laying of the cable may be carried out in accordance with two main principles: Pushing the cable into the stator slots using a cable feeder in accordance with Method 1 as described below or pulling the cable trough the slots using a pull wire in accordance with Method 2 as described below.

Method 1

The cable is disconnected from the first capstan and is pulled out over the drum edge thereof. For a heavy cable, the pulling out may be carried out using a telpher or other facility. A cable guide is mounted on the free end of the cable. The cable guide consists of a cylindrical rod the diameter of which is somewhat smaller than that of the stator slot concerned and its length is about five times its diameter. The cable with cable guide is inserted in a first cable feeder which is located at one side of the stator frame (the upper side). The cable is run by means of the first cable feeder through the stator slot and out thereof on the other side of the stator frame (the under side), where the cable with cable guide, when a sufficient cable length has been advanced, is inserted in a second cable feeder, which is disposed at the other side of the stator frame and is directed towards a successive stator slot in accordance with a predermined winding diagram, so that by means of this second cable feeder the cable is run through said successive stator slot and out thereof on the said one side of the stator frame (the upper side). Here the first cable feeder, which has been directed towards yet another stator slot in accordance with the said diagram, now takes over the cable with cable guide for further transport. It may be necessary to temporarily stop one cable feeder while the other cable feeder advances the cable in a stator slot. The cable feeders are thus driven alternately or simultaneously until the centre marking of the cable gets into a position just opposite the stator slot representing the middle of the coil arc (towards which the first cable feeder was directed at the start).

To achieve the required arc dimension, the cable feeder which has pushed the cable into a stator slot is disconnected and moved. Instead, the cable feeder on the opposite side of the stator frame is connected, which will pull the cable until the required arc dimension is reached.

The work proceeds in accordance with the above mentioned principle, i.e. insertion in one stator slot and return feed in another in accordance with the winding diagram. The free cable end is fed into the intermediate storage means on the capstan or drum which is empty at the time, every other time the first capstan or drum and every other time the other capstan or drum. The arc portions are adjusted continuously by means of the cable feeders.

When the first half of the cable is mounted, the procedure is repeated with the second half of the cable.

The method and the device are special, however, are not exclusively intended to be applied when mounting high-voltage cable on a generator where high-voltage cable is used in the windings of the stator, which cable lacks the outer protective covering normally surrounding it.

The cable is preferably of the kind consisting of an inner core with a plurality of wires, an inner semiconductive layer surrounding the core, an insulating layer surrounding the inner semiconductive layer, and an outer semiconductive layer surrounding the insulating layer, preferably with a diameter of about 20 to 200 mm and a conductor area ranging from 80 to 3000 mm^2.

Method 2

The cable is disconnected from the first capstan and is pulled out over the drum edge thereof. For a heavy cable, the pulling out may take place by means of a telpher or other facility. A pull wire is mounted to the free end of the cable. The pull wire suitably consists of a flexible fibre glass rod having a smaller diameter than that of the cable. At one end of the pull wire, a sleeve with attachment for connection of the cable is provided.

The pull wire is inserted manually into the stator slot from one side of the stator frame (the upper side) and is taken out thereof on the opposite side (the under side). The

pull wire is thereafter inserted in a first cable feeder disposed at the said opposite side of the stator frame. The pull wire with cable is pulled through the stator slot and when a sufficient length has been advanced, the pull wire is inserted in the next stator slot according to the winding diagram. When a sufficient length of the pull wire has been advanced from the said next stator slot at one side of the stator frame (the upper side) it is inserted in another cable feeder disposed there for pulling the cable through the stator slot.

Similarly as in Method 1 it may be necessary to temporarily stop one cable feeder while the other cable feeder pulls the cable in a stator slot. The cable feeders are thus driven alternately or simultaneously until the centre marking of the cable is at a location opposite the stator slot representing the middle of the coil arc (towards which the first cable feeder was directed at the start).

In order to achieve the required arc dimension, the cable feeder that has pulled the cable into a stator slot is disconnected and moved. Instead, the cable feeder on the opposite side of the stator frame is connected, which will pull the cable until the required arc dimension is reached.

The work proceeds in accordance with the above mentioned principle, i.e. pulling through one stator slot and return feed through another in accordance with the winding diagram. The free cable end is fed into the intermediate storage means on the capstan or drum which is empty at the time, every other time the first capstan or drum and every other time the other capstan or drum. The arc portions are continuously adjusted by means of the cable feeders.

When the first half of the cable is mounted, the procedure is repeated with the other cable half.

Brief description of the drawings

The method of the present invention will now be described in more detail by means of preferred embodiments of the device according to the invention with reference to the appended drawings, in which

Fig. 1 shows an example of part of a winding diagram for a stator of a generator,

Fig. 2 is a principal diagram of the method of mounting cables according to the present invention using two capstans as intermediate storage means,

Fig. 3 is a principle diagram of cable mounting according to the present invention corresponding to Fig. 2 using a dual drum capstan as intermediate storage means,

Figs. 4 and 5 show alternative embodiments of the invention with two capstans and a dual drum capstan respectively,

Fig 6 illustrates a preferred embodiment of the capstan machine included in the device according to Fig. 3, and

Fig. 7 illustrates a preferred embodiment of mobile equipment for the cable feeders included in the device.

Description of preferred embodiments

The mounting of windings on the stator for a generator is carried out in accordance with a winding diagram, which may be specific to each generator. In Fig. 1 there is shown an example of such a winding diagram for the stator winding, which forms the basis of the method according to an embodiment of the present invention. In the winding diagram, the stator slots are numbered from 1 to 26 and the positions are numbered from -1 to -4.

The cable, which thus is to form part of the stator winding, is mounted starting from the point representing the centre of an intended coil arc, which thus corresponds to the middle of the predetermined length of the cable. In Fig. 1 said centre is marked by an M. One cable half is thus mounted starting in the stator slot 14-4 and is run to the left in the figure so as to be terminated by the stator slot 4-1. The other cable half is mounted starting in the stator slot 23-4 and is run to the right in the figure to be terminated by the stator slot 13-1.

Fig 2 shows a principle diagram of the method of cable mounting according to the present invention when the cable K to be mounted is delivered wound onto a delivery drum 1 and using two capstans as intermediate storage means. A

predetermined length of the cable K is unwound from the the delivery drum 1, which is coiled onto a drum means, here in the form of a capstan machine 2. During the coiling in the capstan machine 2, a marking is made at the centre of the cable K, i.e. at the point of half the predetermined length, and the cable K is cut off on reaching the full predetermined length.

The actual mounting on the stator S thereafter starts by the free end of the cable K on the capstan machine 2 being led to a first cable feeder A (dashed line in Fig. 2) for laying of the cable in a first stator slot. On leaving said stator slot on the opposite side of the stator frame S, the end of the cable K is gripped by a second cable feeder B, which inserts the cable K in the next stator slot according to the winding diagram. On reaching the end of said stator slot, the cable K is caused to run to a first intermediate storage means formed as a capstan 4. In the capstan 4 such an amount of the cable K is stored that the centre marking thereof will be located just opposite the first stator slot (M in Fig. 1). The cable feeder A is then moved to the following stator slot according to the winding diagram and the free end of the cable half, which is on the capstan 4, will be returned to the cable feeder A. The cable feeder A inserts the free cable end in the said following stator slot, whereupon the cable end on leaving said stator slot on the opposite side of the stator frame S is again gripped by the cable feeder B, which has now been directed towards the succeeding stator slot according to the winding diagram and inserts the cable therein. On reaching the end of said stator slot, the cable is caused to run to a second intermediate storage means 3, also formed as a capstan. Said other capstan 3 will store such a length of the first cable half that the capstan 4 is emptied. The cable feeder A is then moved to the next stator slot according to the winding diagram in order to lay the cable now coming from the capstan 3 therein.

The procedure is thereafter repeated using the cable feeders A and B, the cable K being taken alternately from the capstan 4 and the capstan 3. When the first cable half is

mounted in the slot of the stator frame S according to the winding diagram, the same procedure is carried out with the other cable half, which until now has remained on the capstan machine 2.

In Fig. 3 there is shown a principle diagram of the method similar to the one shown in Fig 2., however with the difference that here a dual drum capstan 30 is employed as an intermediate storage means. Like in the embodiment according to Fig. 2, when the cable K to be mounted is delivered wound onto a delivery drum 1, a predetermined length of the cable K is uncoiled from the delivery drum 1, which length is coiled onto a drum means, in this case too illustrated as a capstan machine 2. During the coiling in the capstan machine 2, a marking is made at the centre of the cable K, i.e. at the point of half the predetermined length, and the cable is K is cut off on reaching the full predetermined length.

In this embodiment too, the actual mounting on the stator S thereafter starts by leading the free end of the cable K on the capstan machine to a first cable feeder A (dashed line in Fig. 3) for laying of the cable in a first stator slot. When the cable K leaves this stator slot on the opposite side of the stator frame S the end thereof is gripped by another cable feeder B, which inserts the cable K in the next stator slot according to the winding diagram. On reaching the end of this stator slot, the cable K is caused to run to the intermediate storage means 30, here formed by the dual drum capstan, which has two drum swinging arms 31 and 31'.

The cable K is received on a drum which is in a coiling position C of the dual drum capstan 30. On this drum such an amount of the cable K is stored that its centre marking will be located just opposite the first stator slot (M in Fig. 1). The cable feeder A is then moved to the following stator slot according to the winding diagram while the swinging arm 31 brings the coiled drum to an uncoiling position D. The free end of the cable half then present on the coiled drum in the D position is again transferred to the cable feeder A. The cable feeder A inserts the free cable end in said following stator slot, the cable end when leaving this stator slot on the opposite side of the stator frame S again

being gripped by the cable feeder B, which has now been directed towards the successive stator slot according to the winding diagram and inserts the cable therein. On reaching the end of said stator slot, the cable is caused to run to the coiling position C in the dual drum capstan 30, whereto its other drum swinging arm 31' has now brought an empty drum. This empty, other drum then stores such an amount of the first cable half that the first drum in the uncoiling position D is emptied. The cable feeder A is then moved to the next stator slot according to the winding diagram while the other drum is moved from the coiling position C to the uncoiling position D' by the drum swinging arm 31'. The cable now coming from the drum in the uncoiling position D' is inserted by the cable feeder A in the new slot. The drum swinging arm 31 of the dual drum capstan 30 returns the empty drum from the position D to the coiling position C in readiness for another coiling operation.

The procedure is then repeated by the cable feeders A and B, the cable K being taken from the dual drum capstan 30 alternately from its uncoiling position D and uncoiling position D'. When the first cable half has been mounted in the slots of the stator frame S in accordance with the winding diagram, the same procedure is carried out with the other cable half, which until then has remained on the capstan machine 2.

In the embodiments of the method according to the invention described above with reference to Figs. 2 and 3, a capstan machine 2 has been employed as a drum means for coiling the predetermined cable length K from the delivery drum 1. It is, however, conceivable to use as a drum means an additional drum, the coiling of which is handled by means of the intermediate storage means, for instance by the dual drum capstan 30. During uncoiling of the cable K, the additional drum is, however, separated from the intermediate storage means and is located in the position taken by the capstan machine 2 in Figs. 2 and 3.

Figs. 4 and 5 are diagrammatic views of the device, on one hand using two capstans 3, 4 as intermediate storage

means, on the other hand using a dual drum capstan 30 as an intermediate storage means in order to realize the above stated method of the invention. These preferred embodiments of the device will now be described in conjunction with the mounting of the cable K on a stator frame S for a 35 kV generator with stepped lap winding in accordance with the arc dimensions G given in Fig. 1 for the various stator slots. The total height of the coil arcs is measured from the laminate plate of the stator frame S to the upper edge of the cable K. The cable dimensions used are between 20 and 60 mm. The predetermined cable length initially present on the capstan machine 2 may amount to around 150 meters.

Mounting begins with inserting the free end of the cable K in the stator slot 14-4 just opposite the starting point C according to Fig. 1. By the term "stator slot 14-4" is meant the stator slot 14, position 4, in accordance with what has been explained with reference to Fig. 1 above. The starting point M also coincides with the centre of the cable K and the centre of the intended coil arc. The first cable half is mounted by following the winding diagram backwards, i.e. to the left in Fig. 1, from the stator slot 14-4 to the stator slot 4-1. The second cable half is mounted correspondingly by following the winding diagram to the right according to Fig. 1, i.e. from the stator slot 23-4 to the stator slot 13-1. The winding diagram shown refers to part of the total stator winding with a number of coil arcs.

Mounting is carried out by pulling one free cable end manually from the drum in the capstan machine 2 to the cable feeder A, which is directed towards the stator slot 14-1 and runs the cable K through the stator slot to the opposite side of the stator frame S. The cable feeder A is stopped when around 4 meters of cable has been fed from the stator slot on this side. The cable end is then gripped by the cable feeder B, which directs the cable end towards the slot 1-3 and runs the cable K through the stator slot while the cable feeder A is activated. The cable end is directed towards the intermediate storage means (4 in Fig. 4; C in Fig. 5). At the cable feeder B the cable K should be bent into an arc of a total height of 700 mm according ot the arc dimension G of the winding diagram and measured to the upper side of the cable.

The cable feeder A is moved to the stator slot 14-2 and the cable K is pulled manually from the intermediate storage means (4 in Fig. 4; D' in Fig. 5) to the cable feeder A to be run through said stator slot to the opposite side of the stator frame. The cable feeder A is stopped when around 4 meters of cable has been fed from the stator slot. The cable K is gripped by the cable feeder B and is directed towards the stator slot 1-1 and is run therethrough. The cable feeder A is activated at the same time and the cable is directed towards the intermediate storage means (3 in Fig. 4; D in Fig. 5), into which the major part of the cable half is run.

At the cable feeder A the cable K should be bent into an arc of a total height of 700 mm according to the arc dimension G of the winding diagram and measured to the under side of the cable.

The procedure is repeated up to and including the stator slot 4-1.

There should now remain a sufficient length of the cable half for connection to the connection terminal U1 of the generator.

Then the free end of the other cable half is pulled from the drum of the capstan machine 2 to the cable feeder A, which is then directed towards the stator slot 23-4. The procedure is then repeated as above, but this time forwards according to the winding diagram, up to and including the stator slot 13-1. At the last stator slot 13-1, the cable should be connected with the next cable, which is to form a successive winding portion J.

The procedure is repeated according to the complete diagram (not shown) for all 36 kV cables, whereafter the same procedure is applied for the 24 kV and 12 kV cables included in the intended generator stator.

In the mounting arrangement according to Figs. 2 and 4 a capstan machine 2 is used, the preferred embodiment of which is shown in more detail in Fig. 6.

The capstan machine 2 comprises a support 21 with a horizontally mounted drum 22, driving equipment 23 for driving a spreader arm 26, a carriage 24 with a lifting and rotating

The capstan machine 2 as well as the embodiment of the intermediate storage means 3 and 4 formed as a coiling device are subject to a copending separate patent application 9700366-9 entitled "Coiling device".

The intermediate storage means 30 in the form of a dual drum capstan is subject to a copending separate patent application 9700370-1 entitled "Dual drum capstan".

With the intermediate storage means formed as a dual drum capstan 30, the capstan machine 2 shown in Fig. 6 may be simplified in that the carriage 24 with the lifting and rotating table 27 can be excluded. The required rotating of the drum 22 180^0 is carried out by each of the drum swinging arms 31, 31' of the dual drum capstan, during the travel between the positions C and D or D'.

In the method according to the present invention, it is to advantage to arrange the cable feeders A and B as mobile devices. As indicated in Figs 4 and 5, the cable feeder A may be disposed on a fork lift truck 61 which is movable on a recessed floor surface under the stator frame S in the stator slots of which the cable K is to be mounted. The cable feeder B may then be suspended in a traverse or telpher above the stator frame S. This traverse or telpher device 62 is depicted also in Fig. 7, from which may be seen that the equipment comprises a mobile work platform 63 with a crane jib 64 and a telpher 65 running therealong. The crane jib 64 is directed radially inwards towards the centre of the stator frame S and the telpher 65 supports the cable feeder B. To advantage, the work platform 63 runs on a floor-mounted rail track.

A cable feeder of suitable construction is subject to a copending separate patent application 9700365-1 entitled "Feeding device".

While the method according to the present invention has been described above in conjunction with preferred embodiments of a device for carrying out the method, it will be understood that said carrying out may be achieved also by means of other devices without departing from the principle of the invention as defined in the appended claims.

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table 27 for rotating the drum 22 180° in the horizontal, a coupling 25 for changing sides of holding of the drum 22 and a boom 28 associated with the spreader arm 26 for coiling and uncoiling of the cable K from the drum 22.

The spreader arm 26 of the capstan machine, in the preferred embodiment, is rotatably mounted on the support 21 and supports a gripping arm 34 for coiling and uncoiling the cable K on the stationary drum 22. Rotation of the gripping arm 34 is caused by means of a belt or chain 38 secured to the support 21, which belt or chain drives a screw device 37 via a screw. The gripping arm 34 is suitably shaped like a curved V-profile having a running track arranged for the cable K which running track is oriented towards the drum 22. The carriage 24 is disposed under the drum 22 and its lifting and rotating table makes possible the said rotating of 180° of the drum 22 by lifting the drum 22 so that the coupling 25 of the drum is disconnected from the support 21, whereafter rotating is carried out and the drum 22 is lowered so that the coupling 25 on the opposite side of the drum is connected with the support 21.

The capstan machine is intended for the rewinding of cables, hoses or the like from large delivery drums (1 according to Fig. 2) to the drum 22, the size of which may be adapted to the immediate requirements. Specific to the capstan machine 2 is that the coiled cable K may be mounted/used from both ends without the cable having to be cut off.

The cable K from the delivery drum is attached to the drum 22 of the capstan machine 2. During the coiling, the cable K is measured so that the predetermined length of cable is coiled before the cable K is cut off. During preparation for mounting in accordance with the method of the present invention, a predetermined length of the cable K is thus coiled from the delivery drum 1 to the coiling drum 22. When mounting on a stator frame S one free cable end is fed to the cable feeder A, as described above with reference to Figs. 2 and 4, the cable then being used successively. When half the predetermined length of the cable is used, the coiling drum 22 is rotated 180° and the other free end of the cable is transferred to the cable feeder A for continued mounting.

CLAIMS

1. A method of mounting a winding, on a stator (S) for a generator **characterized** by the following steps:

a) using cable for the winding, the winding being wound with a number of cables (K) of predetermined lengths for the intended winding of the stator,

b) placing the centre of the cable (K), i.e. the location at half the predetermined length, at the location of the slot (14-4) of the stator (S) representing the middle (M) of an intended coil arc,

c) starting from the said centre ((14-4)of the coil arc, winding the first half cable length onto the stator (S) to form a first coil arc half and part of the complete stator winding, and

d) winding the remaining half cable length onto the stator (S) starting from the said centre (14-4) of the coil arc and in the opposite direction relative to the winding of the first half cable length so as to form the other half of the coil arc on the stator and another part of the complete stator winding.

2. A method according to claim 1 and in cases where the cable is delivered wound onto a delivery drum (1), **characterized** by the following steps:

I) unwinding the cable (K) from the delivery drum (1) a predetermined length, which is coiled onto a drum means (2),

II) during the coiling onto the drum means (2), making a marking at the centre of the cable (K), i.e. at half the predetermined length, and cutting the cable at the predetermined length,

III) carrying out steps a) and b) according to claim 1, the first half cable length up to the said centre (14-4) being uncoiled from the drum means (2) using the intermediate storage means (3, 4; 30),

IV) carrying out step c) according to claim 1, the remaining half cable length being uncoiled from the drum means (2) using the said intermediate storage means (3, 4; 30).

3. A method according to claim 1 or claim 2, **characterized** by the following steps:

A) mounting a cable guide on one free end of the cable (K),

B) inserting the said one free end of the cable (K) in a first cable feeder (A) which is provided at the upper side of the stator frame (S) at the stator slot (14-4) representing the middle (M) of the intended coil arc,

C) running the said one free end of the cable (K) with the cable guide through the stator slot, which extends between the first cable feeder (A) and the under side of the stator frame (S),

D) inserting the said one free end of the cable (K) with the cable guide in a second cable feeder (B) disposed at the under side of the stator frame and running it through a following stator slot according to a predetermined winding diagram,

E) thereafter running the free end of the cable (K) with the cable guide alternately by means of the first and the second cable feeder (A, B) through the stator slots according to the winding diagram until the cable centre marking is just opposite the stator slot (14-4) representing the middle (M) of the intended coil arc, and

F) thereafter repeating steps A) - E) for the other free end of the cable (K).

4. A method according to claim 1 or claim 2, **characterized** by the following steps:

A1) mounting a pull wire to one free end of the cable (K),

B1) inserting the pull wire at one side of the stator frame (S) in the stator slot (14-4) representing the middle (M) of the intended coil arc, so as to emerge from the stator slot at the other, opposite side of the stator frame,

C1) inserting the pull wire in a first cable feeder (A) provided at the other, opposite side of the stator frame (S),

D1) thereafter pulling the pull wire with the cable through the stator slot and inserting it in a following stator slot according to the predetermined winding diagram,

D2) when a sufficient length of the pull wire is fed from the said following stator slot at one side of the stator frame (S), inserting it in a second cable feeder (B) provided at the said one side of the stator frame and pulling the cable up therethrough to be taken over by the first cable feeder (A), which is directed towards the following stator slot according to the winding diagram,

E1) running the cable feeders (A, B) alternately for pulling the cable (K) into the stator slots according to the winding diagram until the centre marking of the cable (K) is just opposite the stator slot (14-4) representing the middle of the intended coil arc, and

F1) thereafter repeating steps A1 - E1) for the other half of the cable (K).

5. A method according to claim 3 or claim 4, **characterized** in that, to provide the required arc dimension (G), the cable feeder (A or B) which has inserted the cable (K) is disconnected and moved while the cable feeder (B or A) on the opposite side of the stator frame (S) is connected, so that the cable is pulled thereby until the required arc dimension is provided.

6. A device for mounting a winding, on a stator (S) for a generator, **characterized** in that the device is arranged to be used for winding with cable comprising a number of cables (K) of predetermined lengths for the stator winding, which device comprises a drum means (2) arranged to initially support the entire predetermined length of a cable, a first and a second cable feeder (A, B) adjustable relative to the stator slots, which cable feeders are arranged to alternately lay the cable (K) in successive stator slots according to a predetermined winding diagram by means of intermediate storage means (3, 4; 30), so that first mounting of a first half of the said predetermined cable length is to be carried out starting from the stator slot (14-4) representing the middle (M) of an intended coil arc and when winding of a first winding portion is completed, mounting of the other winding portion is to be carried out starting also from said stator slot (14-4).

7. A device according to claim 6, **characterized** in that one free end of the cable (K) is feedable from the drum means (2) to the first cable feeder (A) in order to be inserted, on one side of the stator frame (S), in the stator slot (14-4) representing the middle (M) of an intended coil arc, the other cable feeder (B) being disposed at the other, opposite side of the stator frame (S) to grip the cable end emerging from the stator slot on this side and insert the cable end in the following stator slot according to the winding diagram and advance the cable therethrough for intermediate storage in the intermediate storage means (3, 4; 30), which is arranged to store the portion advanced of half the predetermined length of the cable when the centre of the cable (K) is just opposite the stator slot (14-4) representing the middle (M) of the intended coil arc, the first cable feeder (A) being re-directed towards the next stator slot according to the winding diagram in order to insert therein the free cable end taken from the intermediate storage means (3, 4; 30), which on the opposite side of the stator frame (S) is arranged to be gripped again by the other cable feeder (B) so as to be inserted thereby in a following stator slot according to the winding diagram and to advance the cable therethrough for intermediate storage in the intermediate storage means (3, 4; 30), which is arranged to store the rest of half the predetermined length of the cable (K), whereafter the first cable feeder (A) is directed towards yet another following stator slot according to the winding diagram to insert therein the free cable end again taken from the intermediate storage means (3, 4; 30) and to repeat the mounting of one half of the stator (S) with half the predetermined cable length, whereafter the same procedure is arranged to be carried out with the other half cable length which until then has remained on the drum means (2).

8. A device according to any one of claims 6 and 7, **characterized** in that the drum means (2) is formed as a capstan machine, which comrises a support (21) with a drum (22) for storage of the cable (K) on unwinding from a delivery drum (1) and for feeding out the wound cable (K) by using both ends of the cable without the cable being cut off.

9. A device according to claim 8, **characterized** in that the support (21) has a driving equipment (23) for driving a spreader arm (26) and presents means (24; 31, 31') for rotating the drum (22) 180° in the horizontal, the drum (22) having a coupling (25) on either opposite side thereof for being held alternately on the support (21).

10. A device according to claim 8 or claim 9, **characterized** by a boom (28) associated with the spreader arm (26) for coiling and uncoiling of the cable (K) from the stationary drum (22), which spreader arm (26) is rotatably mounted on the support (21) and supports a gripping arm (34) for coiling and uncoiling of the cable (K).

11. A device according to claim 10, **characterized** in that rotation of the gripping arm (34) is arranged to be provided by a belt or chain (38) secured to the support (21), which belt or chain drives a screw device (31) via a screw.

12. A device according to claim 9, **characterized** in that the means for 180° rotation comprises a carriage (24) which is disposed under the drum (22) and has a lifting and rotating table (27) arranged to make possible the said rotation of the drum (22) by lifting the drum (22), so that the coupling (25) of the drum is disconnected from the support (21), whereafter rotation takes place and the drum (22) is lowered, so that the coupling (25) on the opposite side of the drum is connected to the support (21).

13. A device according to any one of claims 6 and 7, **characterized** in that the drum means (2) is comprised of an additional drum, the coiling of which is arranged to take place by means of the intermediate storage means (3, 4; 30), which drum, however, during uncoiling is arranged separately from the said intermediate storage means.

14. A device according to any one of claims 6 and 7, **characterized** in that the intermediate storage means is comprised of two intermediate storage means (3, 4), each of

which is comprised of a capstan, the construction of which is essentially similar to the one of the winding machine (2).

15. A device according to any one of claims 6 and 7, **characterized** in that the intermediate storage means is comprised of a dual drum capstan (30), which has swingable drum swinging arms (31, 31') arranged to alternately pass their drum (22) between a coiling position (C) at the support (21) and an outer uncoiling position (D and D' respectively).

16. A device according to any one of claims 6 and 7, **characterized** in that each cable feeder (A, B) is disposed on mobile means (61, 62) which are arranged to run in separate planes under and above the stator frame (S).

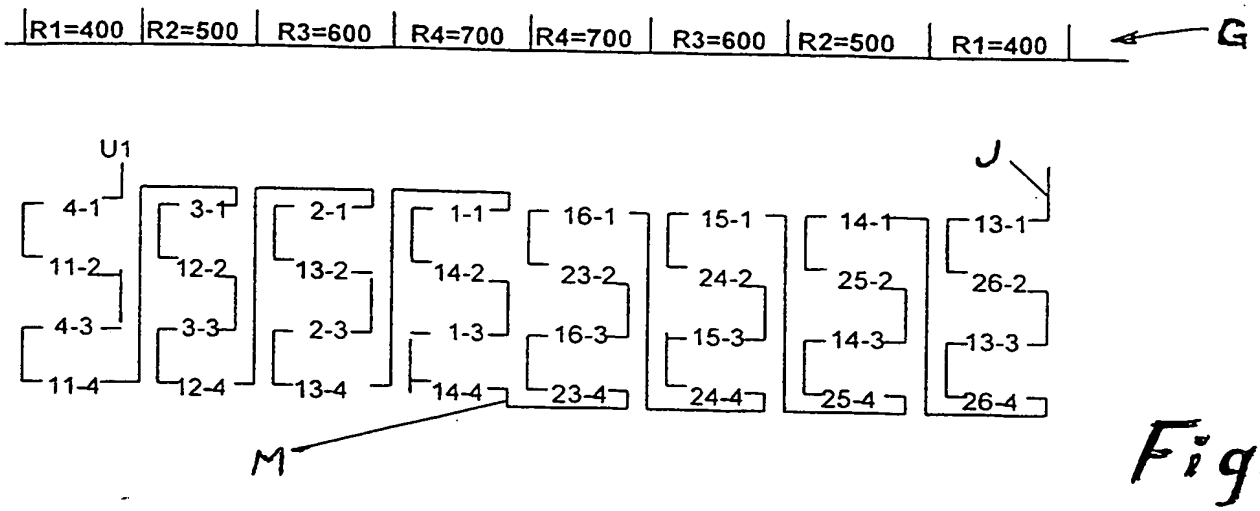
17. A device according to claim 16, **characterized** in that the first cable feeder (A) is supported by a fork lift truck (61), which is slidable on a floor level under the stator frame (S), and the other cable feeder (B) is supported by a traverse or telpher device (62), which is slidable in a plane above the stator frame (S).

18. A method according to any of claims 1 - 5, **characterized** in that the cable is a high-voltage cable.

19. A method according to claim 18, **characterized** in that the high-voltage cable is of a kind comprising a core with a plurality of wires, an inner semiconductive layer surrounding the core, an insulating layer surrounding the inner semiconductive layer and an outer semiconductive layer surrounding the insulating layer.

20. A method according to claim 18 or claim 19, **characterized** in that the high-voltage cable has a diameter ranging from 20 to 200 mm and a conductor area ranging from 80 to 3000 mm^2.

21. A device according to any of claims 6 - 17 used for mounting a cable according to any of claims 18 - 20.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R2=500
R3=600
R4=700
R4=700
R3=600
R2=500
R1=400
G
U1
J
4-1
11-2
4-3
11-4
3-1
12-2
3-3
12-4
2-1
13-2
2-3
13-4
1-1
14-2
1-3
14-4
16-1
23-2
16-3
23-4
15-1
24-2
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24-4
14-1
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25-4
13-1
26-2
13-3
26-4
M

Fig. 1

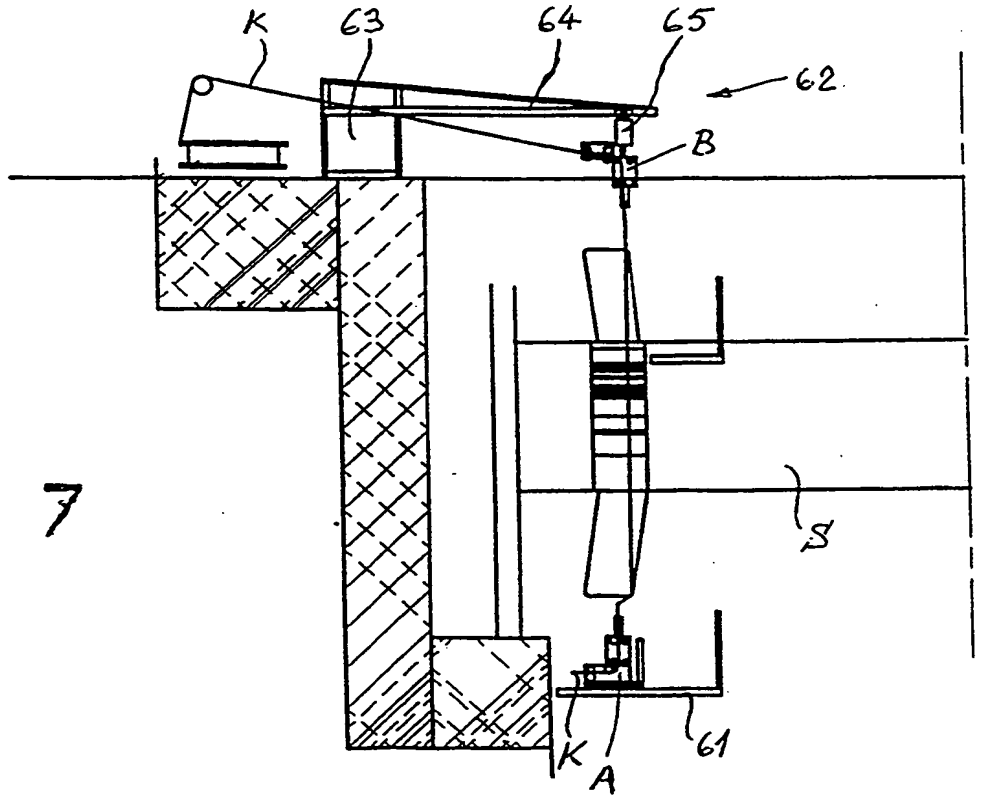

K
63
64
65
62
B
S
K
A
61

Fig. 7

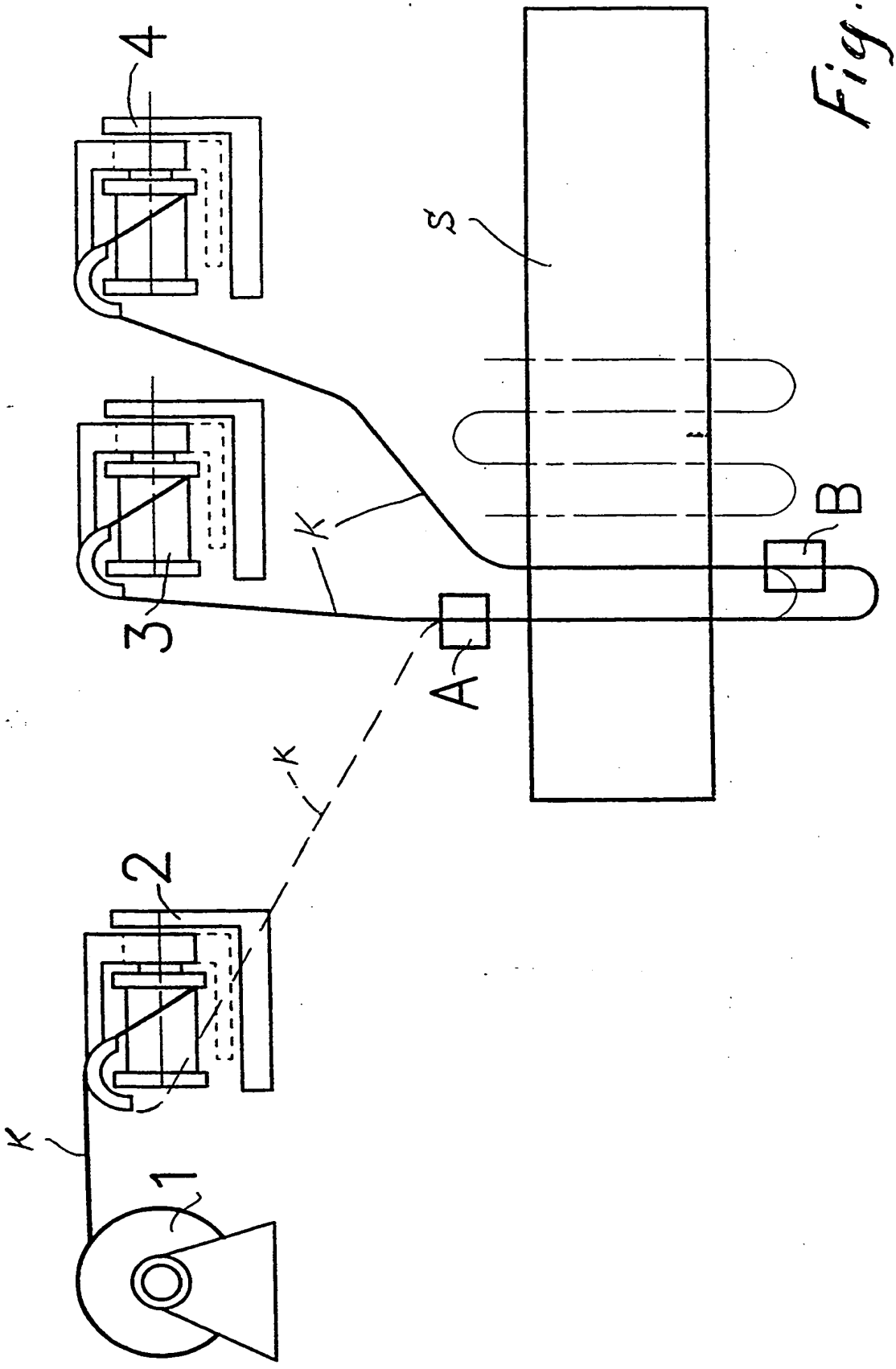


Fig. 2

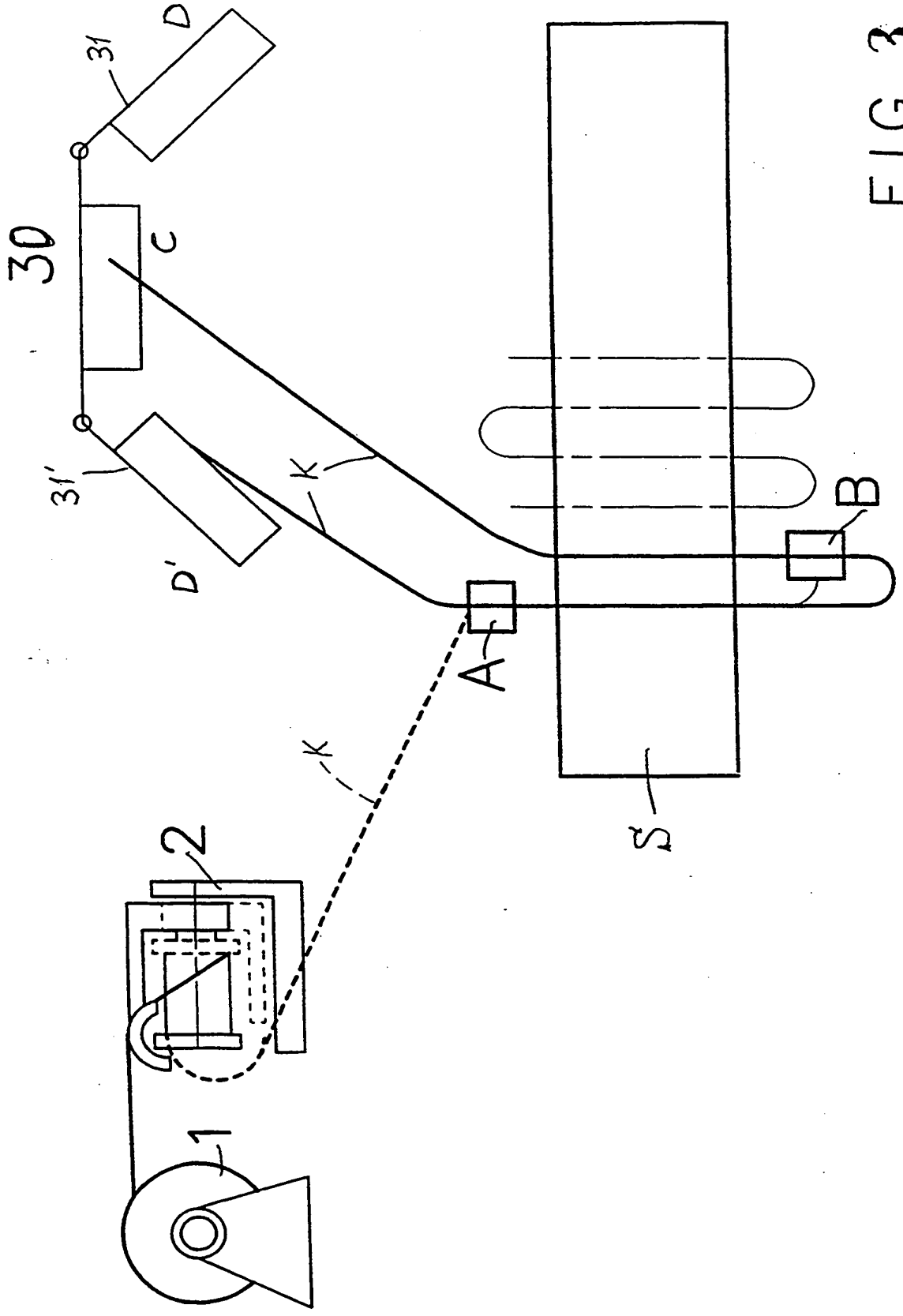


FIG. 3

Fig. 4

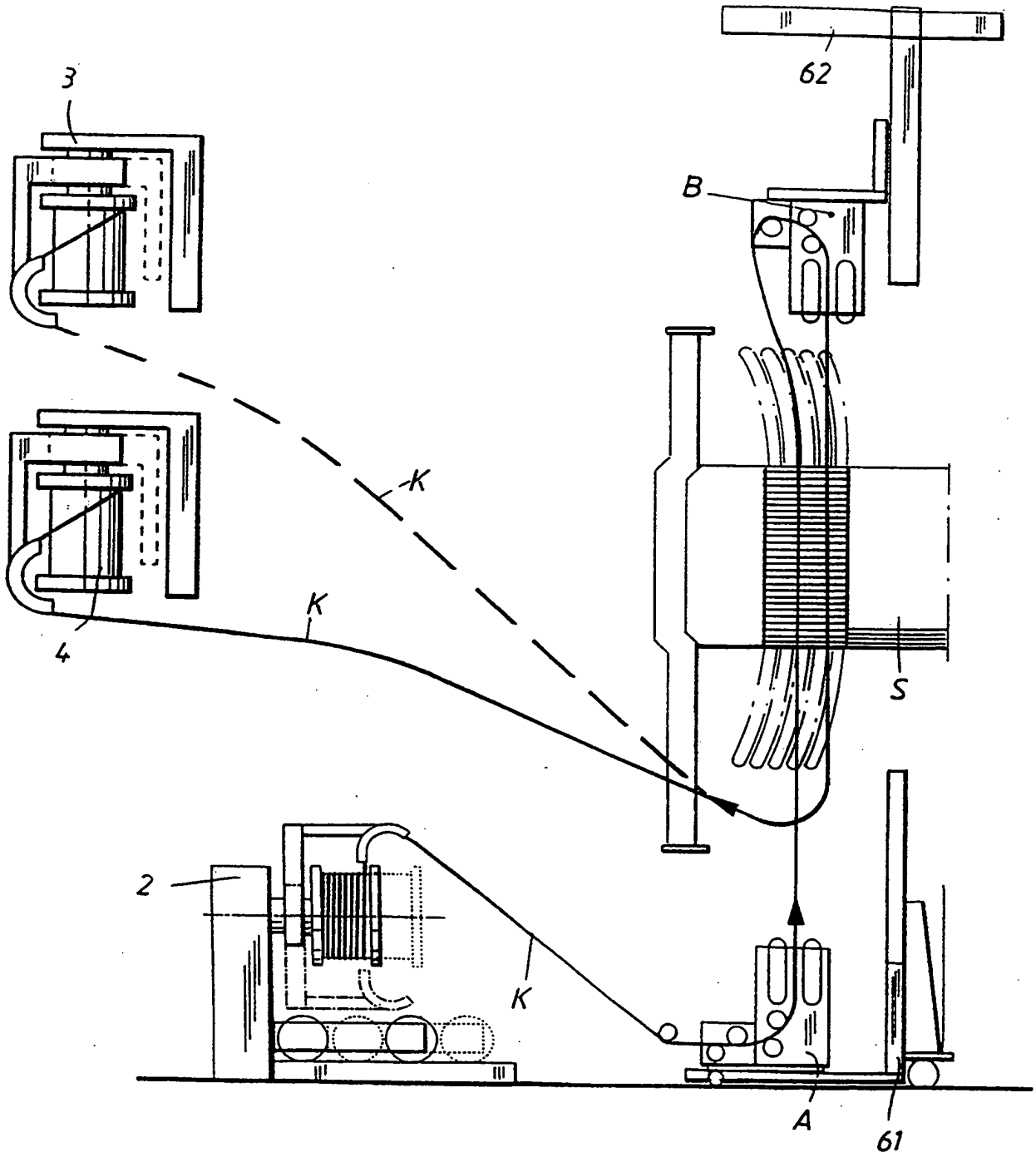
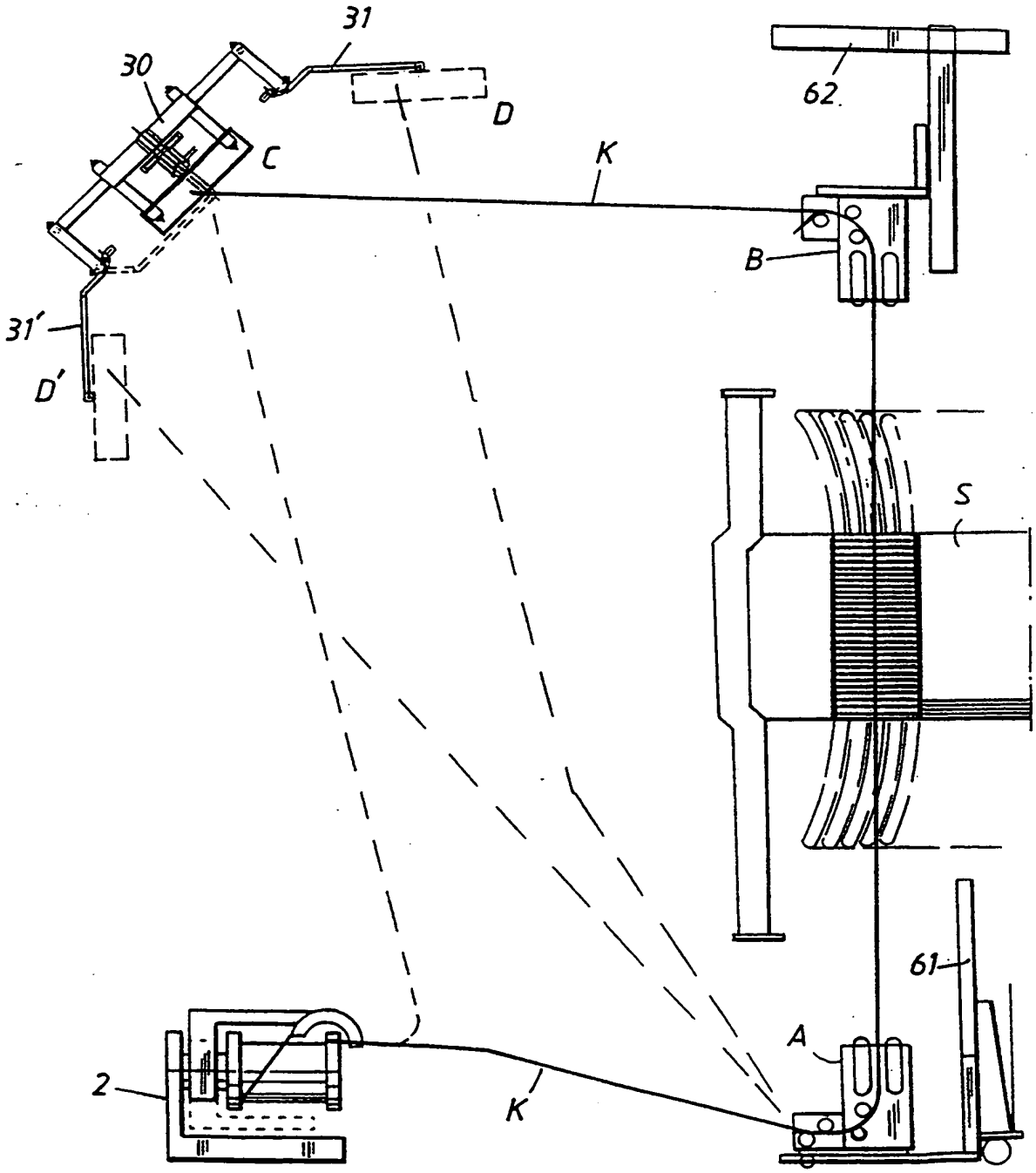


Fig. 5



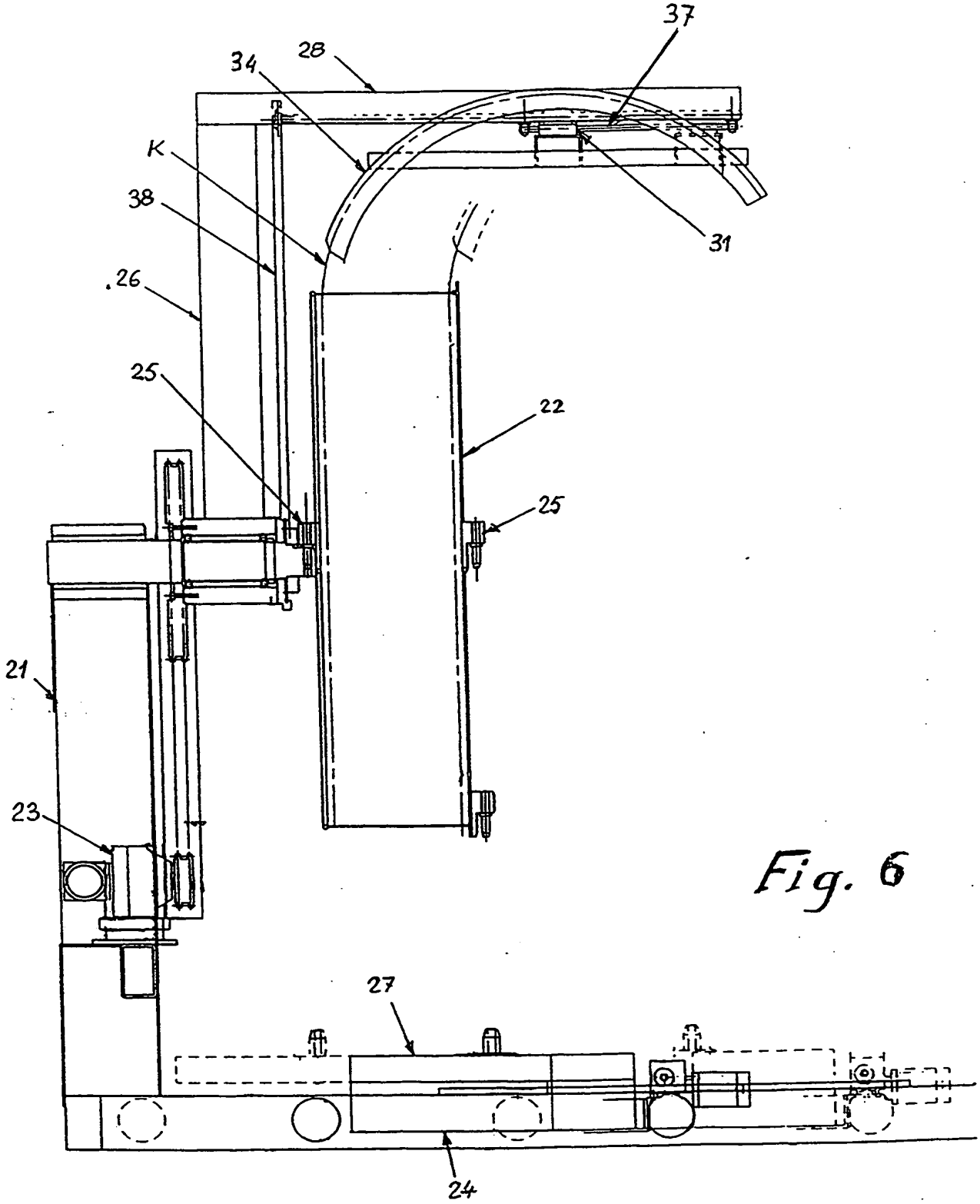


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/00171

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H02K 15/085
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H02K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2708157 A1 (VALEO EQUIPEMENTS ELECTRIQUES MOTEUR), 27 January 1995 (27.01.95), page 5, line 26 - line 30, abstract --	1-21
A	US 5036165 A (R.K. ELTON ET AL.), 30 July 1991 (30.07.91), abstract --	1-21
A	US 3995785 A (R.E. ARICK ET AL.), 7 December 1976 (07.12.76), abstract --	1-21
A	SU 955369 A (GIDROPROEKT RES INST), 30 August 1982 (30.08.82), abstract --	1-21

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 July 1998	03-07-1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Anna Theander Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/00171

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2594271 A1 (SOCIETE DE PARIS ET DU RHONE), 14 August 1987 (14.08.87), abstract --	1-21
A	BE 565063 A (VANDER HAEGHEN), 15 July 1960 (15.07.60), figure 1 -- --------	1-21

INTERNATIONAL SEARCH REPORT

Information on patent family members

09/06/98

International application No.
PCT/SE 98/00171

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		US 4853565 A	01/08/89
US 3995785 A	07/12/76	CA 1009828 A	10/05/77
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		FR 2217851 A,B	06/09/74
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		US 3903933 A	09/09/75
SU 955369 A	30/08/82	NONE	
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